Measuring Commuting in the American Time Use Survey

Gray Kimbrough

University of North Carolina at Greensboro

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Importance of Commuting

Commuting:

- Plays a major role in the decision to work
- Reduces time for other activities
- Impacts household location decisions
- Is unpleasant (Kahneman et al. 2004)
Commuting in ATUS Analyses

- Tradeoffs with other activities, e.g. health-related (Christian 2012)
- Trends over time (DeLoach and Tiemann 2012)
- Disparities by gender and related factors (Kimbrough 2014)
- As covariate in a range of analyses
Advantages and Disadvantages of ATUS

The ATUS contains:

- Respondent characteristics that commonly used transportation datasets lack, such as wage and salary information
- Other uses of time on the same day
- Additional ATUS modules and linkages to CPS panels

But the ATUS does not collect information on trip purposes
What is a commute?

Working definition: Trips from home to work or from work to home

- When these trips are direct—with no stops along the way for other activities—classification is straightforward

- Problems arise when an individual stops along the way
■ ATUS Travel Related to Work
  ■ Travel immediately preceding work spells + uninterrupted travel after work spell if next activity is at home

■ Brown and Borisova (2007)
  ■ All travel between home and work

  ■ All trip tours between home and work with stops of no more than 30 minutes
ATUS Travel Related to Work

- Based on activities before and after travel spells
- Therefore captures:
  - Travel immediately preceding work spells
  - Uninterrupted travel after work spell if next activity is at home
- Used in e.g. DeLoach and Tiemann (2012)

Pros:
- Easy to use: activity code 180501 (170501 in 2003)

Cons:
- Stops (especially on the way home) exclude travel
- Likely also includes some non-commuting (e.g. at lunch)
- Definition changed somewhat between 2003 and 2004
Brown and Borisova (2007)

- All travel between home and work
- Used in e.g. Christian (2012)

Pros:
- Straightforward definition: identify when a respondent is at home and work, and tally up all travel in between

Cons:
- Clearly includes some travel that is not commuting
- Only defined for people who are at both home and work during the day
Trip Tour Methodology

- Applied to National Household Transportation Survey (NHTS) by McGuckin and Nakamoto (2004)

- All travel between home and work with stops of no more than 30 minutes
Trip Tour Methodology

Pros:

- Corresponds reasonably well to concept of commute as travel between home and work, including brief stops but not longer ones
- Defined and used in extensively studied transportation-focused survey

Cons:

- Relatively difficult to calculate
- Arbitrary choice of allowable stop length
- Only defined for people who are at both home and work during the day
Necessary terminology:

- *trip chains*: sequences of travel, possibly including stops;
- *trip tours*: trip chains which contain stops of no more than 30 minutes; and
- *commuting trip tours*: trip tours that begin at home and end at work or begin at work and end at home.

Using this framework, commuting trip tours are:

- Home→Work or Work→Home,
- with stops no longer than 30 minutes.
Additional Complications in the ATUS

- “Personal care” activities do not have associated location
  - Can be significant, especially in morning
  - Solution: Assume that all sleep spells at beginning/end of diary day (4 AM) occur at home. If adjacent activities also have no location, assume these take place at home.

- Different travel modes are, in general, coded as separate travel spells
  - Solution: combine all consecutive travel spells
Sample Information

- 2008 wave of ATUS
- Ages 25-60
- Employed
- Weekdays
- Begin and end diary day at home
### Table 1: Commute Characteristics of Workers in ATUS Sample

<table>
<thead>
<tr>
<th>Nonstop trips between home and work</th>
<th>Percent of Sample</th>
<th>Number of Diary Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least one nonstop home-to-work trip</td>
<td>57.3%</td>
<td>1,573</td>
</tr>
<tr>
<td>At least one nonstop work-to-home trip</td>
<td>46.8%</td>
<td>1,335</td>
</tr>
<tr>
<td>At least one nonstop trip in each direction</td>
<td>37.1%</td>
<td>1,015</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trip tours between home and work</th>
<th>Percent of Sample</th>
<th>Number of Diary Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least one home-to-work tour</td>
<td>70.2%</td>
<td>2,037</td>
</tr>
<tr>
<td>At least one work-to-home tour</td>
<td>60.5%</td>
<td>1,788</td>
</tr>
<tr>
<td>At least one tour in each direction</td>
<td>54.7%</td>
<td>1,615</td>
</tr>
</tbody>
</table>
### Table 2: Average Commute Times in Minutes, ATUS Sample

<table>
<thead>
<tr>
<th>Measure</th>
<th>Time (in minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred Measure:</td>
<td></td>
</tr>
<tr>
<td>Commuting trip tours</td>
<td>37.7</td>
</tr>
<tr>
<td>Other Measures:</td>
<td></td>
</tr>
<tr>
<td>Nonstop commutes only</td>
<td>26.9</td>
</tr>
<tr>
<td>ATUS “travel related to work”</td>
<td>33.3</td>
</tr>
<tr>
<td>All travel between home and work</td>
<td>49.2</td>
</tr>
</tbody>
</table>
Figure 1: Proportion of individuals commuting at times throughout the day, ATUS sample
Other Datasets

- **NHTS**
  - Large
  - Relatively infrequent
  - Transportation-focused
  - Limited other characteristics

- **American Community Survey (ACS)**
  - Very large
  - Yearly
  - Detailed household and individual characteristics
  - Collects only limited commute characteristics: Average time to work and departure time over past week
Analyses

- Aggregate commute time estimates
- Commute time throughout the day, ATUS and NHTS
- To-work commute time, all three
- Departure time, all three
- Regression analysis, ATUS and NHTS
Table 3: Average Commute Times in Minutes

<table>
<thead>
<tr>
<th>Sample</th>
<th>To-work travel</th>
<th>Total work travel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full sample</td>
<td>Excluding zeros</td>
</tr>
<tr>
<td>ACS</td>
<td>25.0</td>
<td>26.1</td>
</tr>
<tr>
<td>NHTS</td>
<td>18.5</td>
<td>28.6</td>
</tr>
<tr>
<td>ATUS</td>
<td>19.6</td>
<td>27.9</td>
</tr>
</tbody>
</table>
Figure 2: Proportion of individuals commuting at times throughout the day, ATUS and NHTS samples
Figure 3: Proportion of individuals commuting to work at times throughout the day
Figure 4: Distribution of departure times to work

![Graph showing distribution of departure times to work]

- **Percent of Departures to Work**
- **Time of Day, half hour intervals**
- **Legend:**
  - ATUS
  - NHTS
  - ACS
Table 4: Multivariate Analysis F-test Results

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pooled Characteristics</strong></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Education Levels</td>
<td>.218</td>
</tr>
<tr>
<td>Age Brackets</td>
<td>&lt;.001</td>
</tr>
<tr>
<td><strong>ATUS indicator</strong></td>
<td>.798</td>
</tr>
<tr>
<td><strong>Interacted characteristics</strong></td>
<td></td>
</tr>
<tr>
<td>Sex × ATUS</td>
<td>.389</td>
</tr>
<tr>
<td>Education × ATUS</td>
<td>.060</td>
</tr>
<tr>
<td>Age × ATUS</td>
<td>.591</td>
</tr>
<tr>
<td><strong>Total of ATUS indicator and interactions</strong></td>
<td>.102</td>
</tr>
</tbody>
</table>
The trip tour methodology from the NHTS can be applied to the ATUS

Estimates from the ATUS using this methodology are in line with those from the NHTS

True both in aggregate and at times throughout the day

Also in line with measures from the ACS

Multivariate analysis shows no systematic differences between estimates from NHTS and ATUS using a small set of individual characteristics

This methodology allows for additional analyses leveraging the strengths of the ATUS, with advantages over using activity code for travel related to work